Monitoring Ute Ladiesí-tresses (*Spiranthes diluvialis*), in Jefferson County, Montana

Final Report, 1996-2000

Prepared for:

Bureau of Land Management
State Office and Butte Field Office

Prepared by:

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MONTANA
Natural Heritage
Program

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Final Report, 1996-2000

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Executive Summary

We monitored one population of Ute ladiesí-tresses (*Spiranthes diluvialis*), a wetland plant designated as threatened under the Endangered Species Act, in order to:

- help interpret the results of baseline surveys,
- provide preliminarily assessment of population trend,
- identify critical life history stages, and
- guide future management actions.

Rigorous trend analysis and identification of critical life history stages were not possible because we had only two-to-three years of data on the ìseasonally-dormantî stage. This stage remains underground throughout the entire growing season and cannot be discerned from plant mortality except after dormancy duration and mortality rates have been calculated. Preliminary analysis indicates that season-long dormancy exceeds two years.

Management recommendations include avoiding direct impact to the flowering stage, providing annual or periodic reduction in competing vegetation, and conducting multi-year monitoring to evaluate any management action changes.

Acknowledgements

This monitoring study began as a task added to the *Spiranthes diluvialis* status survey supported under the U.S. Fish and Wildlife Service Section 6 cooperative agreement with the Montana State Library through its Montana Natural Heritage Program.

It was continued for two of the following three years under Bureau of Land Management challenge cost-share agreements with the Montana Natural Heritage Program. Landowner access permission and coordination are also acknowledged with appreciation.

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Introduction

Ute ladiesí-tresses (*Spiranthes diluvialis*) is a wetland plant designated as threatened under the Endangered Species Act (Federal Register 1992). It was first documented in Montana in 1994, at the northern end of its range (Heidel 1996, 1998). This report describes demographic monitoring begun in 1996 to help interpret the results of baseline surveys, identify critical life history stages, assess population trend, and guide future management actions. This study, along with previous surveys provides information on species biology that will help assess threats and recovery needs.

Spiranthes diluvialis is restricted to low-elevation valleys. In Montana, it is further restricted to specialized valley bottom soil and hydrology conditions, in habitat that is altered or fragmented by agriculture. Previous speciesí monitoring studies suggested downward trends under most land uses and settings (Arft 1995). We hypothesized that the same vulnerability if not trends, exists in Montana.

Species Background

Ute ladiesí-tresses (*Spiranthes diluvialis*) is a long-lived perennial with a flowering stalk arising from clusters of basal leaves and short, tuberously thickened roots. The species reproduces strictly by seed. The flowers are protandrous (i.e., with staggered development of the male and female organs in each flower), and are pollinated by bumblebees (Sipes and Tepedino 1995). Flowering and vegetative growth forms are illustrated in Figures 2 and 3.

In Montana, most vegetative plants have one-to-few basal leaves but may have as many as seven. Vegetative plants that we studied ranged mostly from 3-8 centimeters in height, though in 1998, a poor-flowering year, some vegetative plants produced leaves only 1 centimeter in length. Flowering lasts at least three weeks in August with typically 9-17 flowers [4-25] per inflorescence. The species is highly palatable, and we often found browsed plants, even when the surrounding grass was not touched.

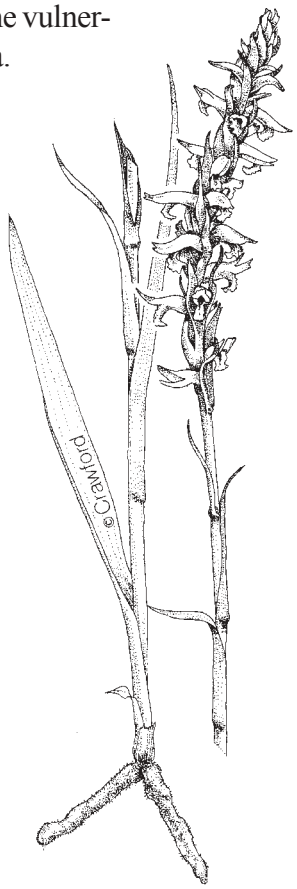


Figure 1. Illustration of *Spiranthes diluvialis* by Carolyn Crawford

Figure 2. *Spiranthes diluvialis* in flower

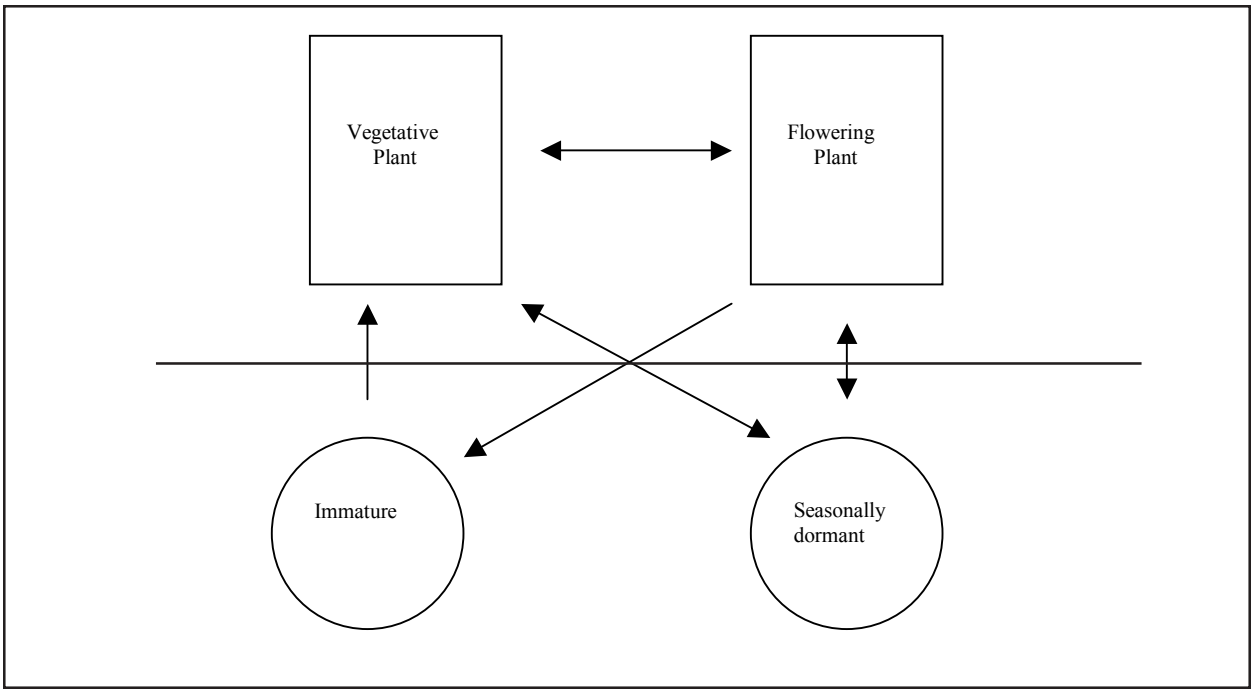
Figure 3. *Spiranthes diluvialis* in vegetative stage

In any given year, mature plants are in flowering, non-flowering (vegetative) and seasonally dormant stages (persisting belowground; Lesica and Steele 1994). The species can be reliably located only when it is flowering, unless other vegetation cover and thatch are removed or precise locations are recorded to relocate vegetative plants. To monitor a species in which only one of three mature life history stages can be reliably located requires extended monitoring to map vegetative plants and determine the mean duration of seasonally dormant plants. Thus, repeated years of monitoring are needed to establish base population numbers. Previous researchers determined that mature plants do not remain in a vegetative state for more than one year (Arft 1995b, Riedel et al. 1995), but the unknown duration of seasonal dormancy has not been determined. A simplified life history diagram is presented below (Figure 4).

The thick tuberous roots depend on mycorrhizal fungi for enhanced water and nutrient absorption, as do other members of the Orchid Family (Wells 1981). Another species of *Spiranthes* has been shown to persist for up to nine years as an immature subterranean parasite or symbiont, before producing aerial shoots (Tamm 1972). Thus, it is possible that there are subterranean stages of immature as well as mature *Spiranthes diluvialis* plants. No juvenile plants were observed during the course of this monitoring study, and we did not consider immature plants for all practical purposes.

These are the same categories used in the previous monitoring studies (Arft 1995, Riedel et al. 1995) except that the other studies included a class of flowering plants in which an inflorescence formed but did not set any fruits. This phenomenon was absent in Montana, though sometimes the latest and youngest fruits on some inflorescences aborted.

Figure 4. Life History of *Spiranthes diluvialis*



In the previous monitoring study, the flowering stage was identified as the most critical stage of life history in mature plants. Early-season haying and grazing, and vole herbivory of the inflorescences, at least under grazed and mown conditions, were identified as a major limit to reproductive success.

We did not follow the species over the course of the growing season but have growing season information from Colorado for background (Arft 1995). In June the plants emerge. They flower in July, up to a month earlier than in Montana. They produce an over wintering rosette in late summer.

Habitat and Study Site

Throughout much of its range, *Spiranthes diluvialis* occupies mid-seral riparian habitat, and may depend on some degree or frequency of habitat disturbance (Arft 1995, U.S. Fish and Wildlife Service 1995). The species occurs in meandered wetlands at low elevations in open valley bottom settings.

In Montana, *Spiranthes diluvialis* habitat occupies a delta-like setting of meandered wetlands where there is consistently a shallow water table, calcareous soils, and gravelly alluvium at or near the rooting zone that is saturated in spring and remains moist through the growing season. These areas are not and were not linked to active alluvial processes but offer a low-competition setting. Valley soils immediately above and surrounding the meandered wetlands are classified as salt-affected wetland soils; they include fine, silty mixed aquic calciorthids and fine, loamy mixed fluvaquents or fluvaquentic haploborolls. The status report provides more detailed description of Spiranthes diluvialis habitat soils, and the Madison County soils survey (Boast and Shelito 1989) provides more detailed descriptions of the surrounding soils. The surrounding salt-loving and salt-tolerant vegetation near *Spiranthes diluvialis* wetlands is dominated by alkali sacaton (*Sporobolus airoides*). Other species that are often present in or near the wetlands include buffaloberry (*Shepherdia argentea*), greasewood (*Sarcobatus vermiculatus*) and inland saltgrass (*Distichilis stricta*). Speciesí vegetation in Montana is also described in much greater detail in the status report (Heidel 1998.)

The shallowness of the soil indicates a slow rate of soil buildup and slow successional process, which may account for the ability of *Spiranthes diluvialis* to persist. Many of these wetlands have areas of marl accumulation, and indeed, Lewis and Clark avoided walking the valley bottoms to avoid the risk of entering ìbogsî (Nell and Taylor 1996). Disturbances such as bison grazing and fire may have historically helped maintain the low-competition habitat required by this species.

Our monitoring site is the first documented Montana locality for *Spiranthes diluvialis*, a typical meandered wetland setting. The depth of the basin is less than 1 meter, and it is surrounded by salt-affected soils dominated by alkali sacaton (*Sporobolus airoides*) with widely scattered buffaloberry (*Shepherdia argentea.*) At the monitoring site, *Spiranthes diluvialis* is restricted to the irregular margins of the wetland, where the vegetation cover is relatively tall and dense compared to other sites, comprised of species like plains reedgrass (*Calamagrostis inexpansa*), clustered field sedge (*Carex praegracilis*), and bearded wheatgrass (*Elymus trachycaulus*).

Figure 5. Study Site

In other sites, short-stature graminoids like copycat sedge (*Carex simulata*) and few-flowered spikerush (*Eleocharis pauciflora*) assume a great or greater dominance. The study site is part of a small pasture with a history of livestock grazing, usually in early summer. The practice of early summer grazing continued during this study. In 1997, cattle were not removed until after flowering had started, and a high incidence of herbivory was noted.

Fire was a common tool of tribes in the headwaters area to manipulate bison movement (Nell and Taylor 1996). An arson fire took place at the monitoring site in January 2001and burned the entire occupied habitat. The field visit in August indicated that the fire thoroughly burned the uplands but in the wetland it left the thatch and litter partially burned, with stubble standing. Light snow cover or slight topographic relief may have reduced the effects of the burn in the wetland. The fire-prone climate of *Spiranthes diluvialis* habitat is characterized by a hot drought period. This also coincides with flowering time in the latter half of summer, as shown at the most similar weather monitoring station at Twin Bridges, MT.

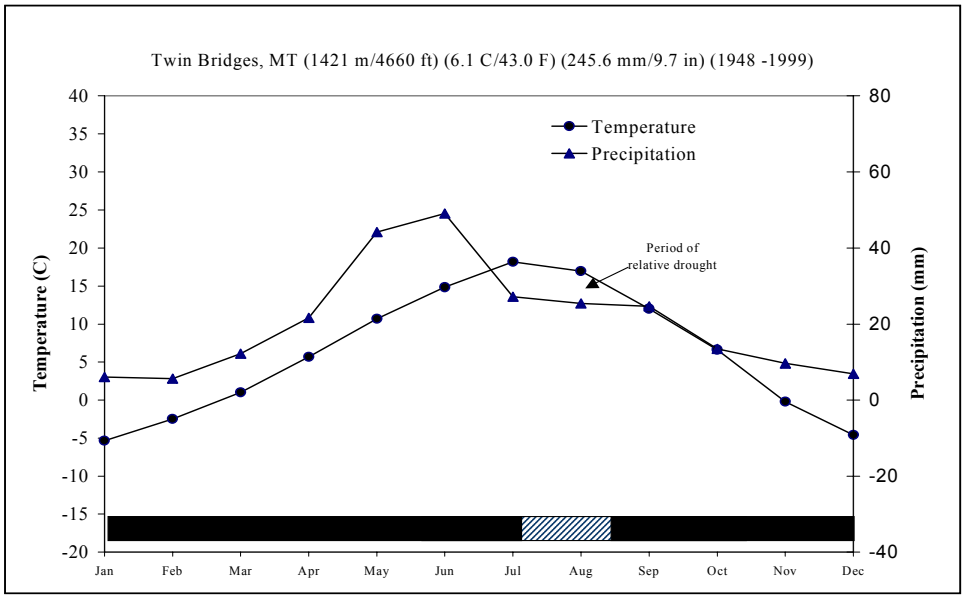
Methods

The monitoring plot was established in 1996 to track the entire population, one that is restricted to a single wetland basin and falls within an area of about 20 x 30-meters (Heidel 1998). One-meter rebar stakes pounded to within 0.3-meters of the surface were used to mark the four outer corners of the plot, except that the northern stakes fell 2-meters short of the maximum population extent. All rebar were placed in shrubs to be inconspicuous and avoid interference with livestock movement and visitors.

The plot was mapped out with X & Y coordinates using a 30-meter tape along the southern boundary as the ìX axisî (facing north), and another along the northern boundary to ensure consistent orientation of the ìY axisî between tapes. A single tape was moved along the ìY axisî from left to right (west to east) and meter sticks were used to delimit 1 x 1-meter areas.

Individual plants were mapped within each subplot to at least 0.1-meter accuracy. The population was concentrated in relatively narrow bands along the wetland margin requiring care to avoid

Figure 6. Climate of Twin Bridges



This diagram shows average monthly temperature and precipitation. The growing season length is the number of frost-free days, i.e., with mean daily minimum temperature above 0° C.

trampling plants when moving up the ìY axisî.

For flowering plants, the numbers of buds (unopened flowers; B), open flowers (F), and fruits (R), and any aborted fruits (A) were recorded per flowering stem. Stems closer than 2-centimeters were treated as shoots from the same plant; paired flowering stems were uncommon and noted as such for vegetative plants, and the total number of basal leaves was recorded. We also noted any browsing (b) or trampling (t) of flowering stems or basal leaves.

Monitoring began during the middle of flowering in 1996, but moved to the end of the flowering period in all following years in order to gather data on seed set and avoid damaging shoots that had not bolted. This nearly eliminated data on buds, replacing it with data on fruits and aborted fruits for fecundity analysis. In general, flowering plants that were browsed were still discernible.

We used monitoring methods that were comparable to previous monitoring studies of Arft (1995) and Riedel et al. (1995), with one exception. In an effort to avoid undue attention to the plants we did not tag plant locations along a heavily traveled public road. We used the same life history categories except we did not have a category to represent those flowering plants that did not set fruit. This phenomenon was not present in the study area (discussed previously). The Arft study had the added benefit of tracking plants throughout the growing season so that any herbivory or other losses were more easily identified as such.

Results and Discussion

Monitoring results provide a basis for interpreting the status survey results in Heidel (1998). We developed a formula for extrapolating population counts of flowering stems to actual population estimates, including vegetative and seasonally dormant (underground) plants. If the total number of plants that flowered during the five-year monitoring period (total=204) represents the best estimate of population size, then the number of plants that flower in any given year represents the proportion of flowering/nonflowering [vegetation + seasonally-dormant] plants. The flowering stem number counts ranged from 11-95 plants, i.e., 5% - 46% of the estimated total population number. Even in a ìgoodî flowering year, just over half of the plants cannot be reliably located because they are belowground or inconspicuous among thatch and taller vegetation cover.

Using the 2X factor as a conservative basis for extrapolation, the estimates of 1,574 plants tallied from all twelve presently known populations in Montana represent a total of at least 3,148 plants in the state. Most of the population estimates were made during survey that took place in 1997. At the monitoring site in 1997, only 18% of the plants flowered (36 out of 204). If we adjust statewide estimates using a 5X factor as a more realistic basis for extrapolation, there are at least 7,870 plants in the state. Whichever estimate is used to adjust survey numbers, the total number of *Spiranthes diluvialis* plants in all Montana populations is less than the estimates for a couple of the largest populations in states to the south. This might be expected because most of the habitat in Montana occurs in highly interrupted linear bands rather than in semi-continuous river corridor bands or broad meadows.

These interpretations are based on several assumptions. By using the tally of 204 plants at the monitoring site as representing total population size, we assume that all of the plants flowered at least once during the five-year period, and that there was no mortality. In extrapolating population numbers throughout Montana based on this data, we also assume that different populations have similar proportions of plants flowering.

The data also indicate that population estimates and even presence/absence determinations in ìpoorî years have marginal merit, and actual populations are likely to be higher than estimates

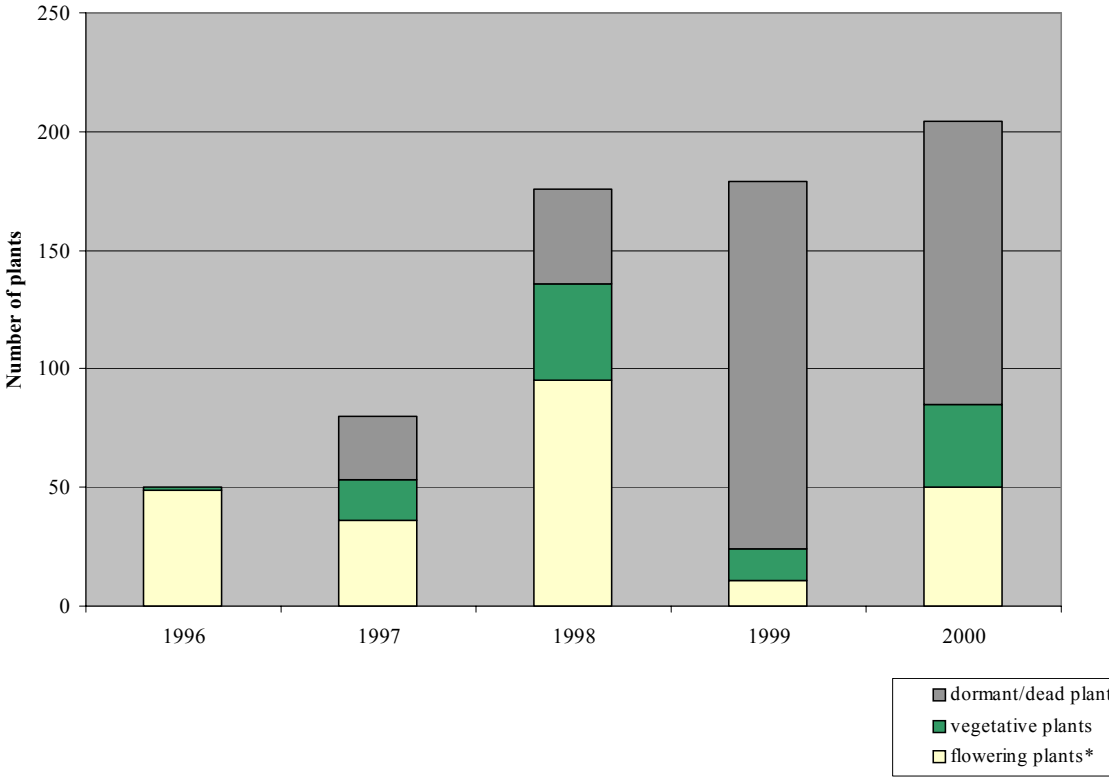
using flowering-plant counts from these years. Survey results during a poor year are almost always preliminary, and a postponement or extension of survey to the following year is preferable whenever it is possible. Thus, June monthly rainfall and temperature conditions should be reported with any survey results noting their difference from the mean. Exceptionally cool, wet years are to be avoided for Section 7 consultation surveys for *Spiranthes diluvialis* whenever possible, a term that is appropriate to add to recommended Section 7 guidelines in Montana (Heidel 2000).

This study provides evidence that flowering patterns shift with microhabitat between years. At our monitoring site, *Spiranthes diluvialis* was restricted to wetland margins within a 2-3 meter band. Some places of the wetland consistently had flowering plants, but there were often different patterns of flowering plant distribution in corners of the wetland and at different positions on the margin from year to year.

Life History and Trend

Monitoring results show flowering levels varied by nearly one order of magnitude from year to year (11-95 flowering plants in 1999 and 1998, respectively; Figure 7.) Plants can only be tracked once they have flowered. In the past three years, the number of ìnewî plants has leveled off, indicating that we have documented the majority of plants. The most favorable year for flowering during the monitoring period occurred in 1998, and by the third year of monitoring, we had documented 86% of the plants that flowered within the five-year period. In general, the speciesí best flowering years seem to correspond with extreme heat during flowering. This is revealed in a review of the five years of climate data from the nearest monitoring station of similar habitat at Twin Bridges. Preliminary review of the climate data also indicates that growing seasons that start out as relatively cold and wet, as indicated by mean June values, correspond with low flowering levels. For species that remain dormant throughout one or more growing seasons, trend cannot be determined until the average number of years is calculated in which the plant is dormant

Figure 7. Monitoring overview of *Spiranthes diluvialis*



(Lesica and Steele 1994). Therefore, our data do not provide adequate basis for evaluating population trend and critical life history stages. Most species that exhibit the seasonal dormancy phenomenon do not remain dormant for more than one growing season, with the exception of many members of the Orchid Family (Lesica and Steele 1994).

In this study, the first year of monitoring in 1996 located almost 25% of all plants that were found to flower over the course of the five-year monitoring period (50 plants). Of the ones that went dormant in 1997, about half of these ended their dormancy between 1998-2000 and had a mean dormancy duration of 1.6 years. Of the ones that went dormant for the first time in 1998, only 24% ended their dormancy by 2000 and had a mean dormancy duration of two years. This demonstrates that the mean length of season-long dormancy is a multi-year value of at least two years in Montana. Both sets of data are graphed in Figure 8. Two years of lead-time is needed to evaluate the duration of season-long dormancy so we were limited to a 3-year period for evaluating its duration. It would be necessary to extend this study for at least two more years to quantify the average dormancy duration, and then evaluate trend using a t-test or stage-based transition matrices. It is possible that the viability projections run for *Spiranthes diluvialis* in Colorado, based on three years of monitoring data (Arft 1995), included assumptions that season-long dormancy does not last more than one year. In any case, the three years of data from the Colorado study sites are inadequate for making projections without knowing more about the duration of dormancy. Viability projections should be re-run with documented season-long dormancy values derived in the region or modeled values.

Unlike the dormancy stage, the average length of the flowering and the vegetative stages of *Spiranthes diluvialis* at the study site are little more than one year.

Prolonged dormancy is often associated with environmental stress (Rabotnov 1969), particularly episodes of drought among terrestrial plants. In some wetland species, prolonged dormancy is associated with prolonged inundation. The latter may also apply to *Spiranthes diluvialis*, since the rooting zone remains saturated long into the growing season.

Comparison with Other Monitoring Studies

The monitoring site in Jefferson County, Montana is representative of speciesí habitat at the northern limits of the speciesí range, east of the Continental Divide. Warning signs such as decline in populations, fruit set problems and other damages that were noted in the Colorado and Utah monitoring studies (Arft 1995, Riedel et al. 1995) were not confirmed in this study:

- We did not detect decline in population numbers even if we assume that seasonal-long dormancy lasts for only one year.

- We did not find evidence of fruit set problems. Instead, we found high fruit set and observed bumblebees selectively pollinating the species in spite of its relatively small flowering plant numbers.

- We did not find direct signs of damage that were proven or suspected of causing mortality. Most plants with browsed inflorescences or leaves were found to survive in later years. There were no signs of rodent activity in the particular habitat occupied by the species (runways and tunnels), indicating that vole herbivory seemed an unlikely limit on reproductive success.

It is possible that this population is less vulnerable under existing land management practices and environmental conditions than larger populations

Figure 8. Dormancy duration of *Spiranthes diluvialis*

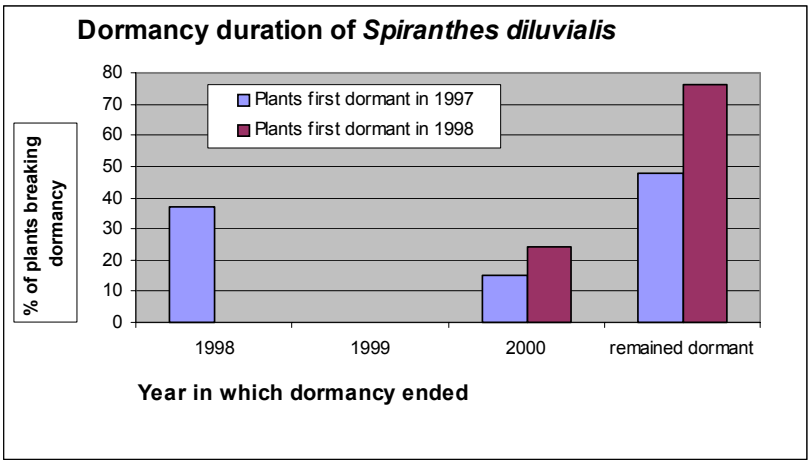


Figure 9. Vegetative stage duration of *Spiranthes diluvialis*

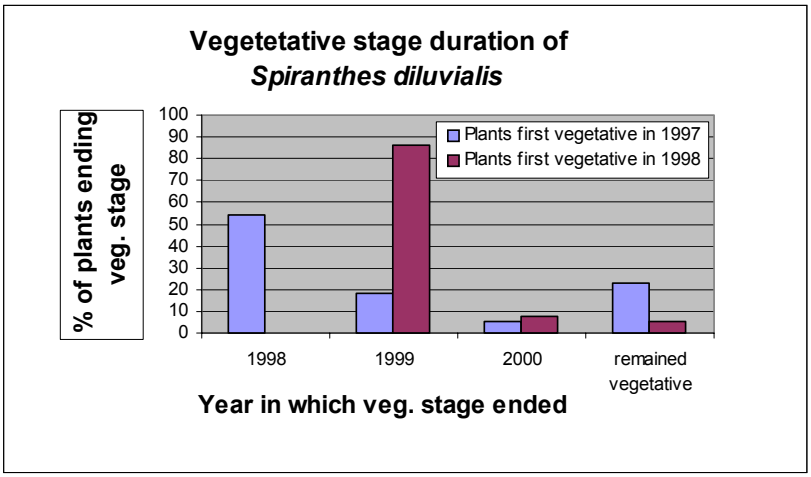
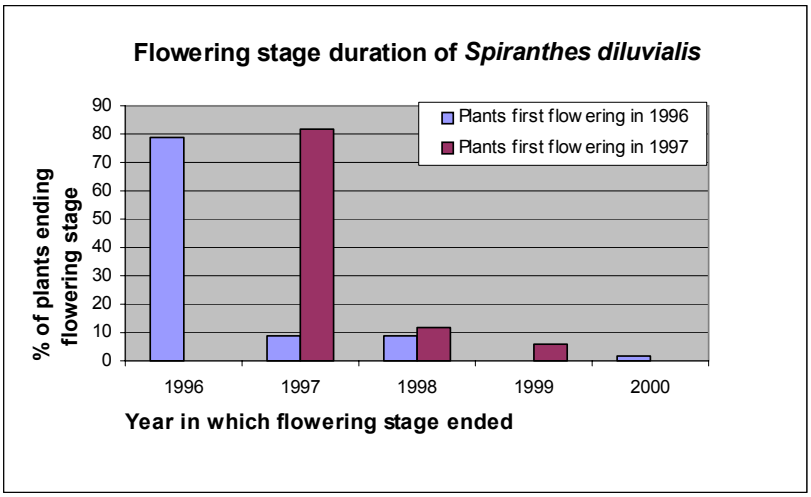


Figure 10. Flowering stage duration of *Spiranthes diluvialis*



monitored in the center of its range. The population is not necessarily invulnerable, and we note that there is almost no protection of the species under the Endangered Species Act in Montana because it does not occur on federal lands and is scarcely affected by federal actions (Heidel 1998.)

Guide to Future Management Action

The flowering stage is readily impacted by management actions, and the infloresences represent large, sporadic investments of resources that are highly accessible to herbivores and highly palatable. The flowering stage is a vulnerable stage, even though we were not able to determine which life history stage is the most limiting in speciesí viability. We echo the management recommendations to come out of the Arft (1995) research, i.e., to avoid removing flowering stalks under grazing or mowing by a shift in timing that avoids removal of the inflorescence after it bolts or before seeds disperse.

We did not identify new threats. The invasion of noxious weeds near and into species habitat poses a direct threat to the species through habitat degradation and the potential impact of herbicides. Further consultation or research is needed to evaluate the influence of broadleaf herbicides on this species.

The lack of experimental controls or robust baseline provided an inadequate basis to evaluate grazing practices or the recent arson fire. The inadvertent delay in moving livestock in 1997 confirmed that cattle selectively graze inflorescences. The persistence of this species in relatively high vegetation cover and tall-stature vegetation cover at the particular monitoring site may in fact be linked to the long-standing grazing regime. Continuation of current grazing practices is recommended, in concert with noxious weed control. Grazing appears to be a viable option for annual or periodic reduction of competing vegetation in such settings.

If there is followup to the draft recovery plan (U.S. Fish and Wildlife Service 1995), and development of Riparian/Aquatic Habitat Management Objectives (RMOs) across its range or Standards and Guidelines for southwestern Montana, then it will be necessary to address grazing, weed management, fire, and groundwater flow. An intensive demographic monitoring baseline that tracks individual plants and quantifies the season-long dormancy stage of life history is recommended for any management changes in Montana that are prompted by conservation, in order to gauge the effectiveness of guidelines and recovery efforts.

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APPENDIX A. Global and State Rank Guidelines

The term ìspecies of special concernî includes taxa that are rare, endemic, disjunct, threatened or endangered throughout their range or in Montana, vulnerable to extirpation from Montana, or in need of further research. The term also encompasses species that have a special designation by organizations or land management agencies in Montana, including: Bureau of Land Management Special Status and Watch species; U.S. Forest Service Sensitive and Watch species; U.S. Fish and Wildlife Service Threatened, Endangered and Candidate species.

Taxa are evaluated and ranked by the Heritage Program on the basis of their global (range-wide) status, and their statewide status according to a standardized procedure used by all Natural Heritage Programs. These ranks are used to determine protection and data collection priorities, and are revised as new information becomes available.

For each level of distributionóglobal and stateóspecies are assigned a numeric rank ranging from 1 (critically imperiled) to 5 (demonstrably secure). This reflects the speciesí relative endangerment and is based primarily on the number of occurrences of that species globally or within the state. However, other information such as date of collection, degree of habitat threat, geographic distribution patterns and population size and trends is considered when assigning a rank, and the number of occurrences listed below are suggestions, not absolute criteria.

For example, Clustered ladyís slipper (Cypripedium fasciculatum) is ranked G4 S2. That is, globally the species is apparently secure, while in Montana it is imperiled because of rarity, or because of other factors making it demonstrably vulnerable to extirpation.

For ranks, substitute S (State) or G (Global) in these definitions

Rank	Definition
1	**Critically Imperiled**ó Critically imperiled because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation. Typically 5 or fewer occurrences c very few remaining individuals (<1,000).
2	**Imperiled**ó Imperiled because of rarity or because of some factor(s) making it very vulnerable to extirpation. Typically 6 to 20 occurrences or few remaining individuals (1,0(to 3,000).
3	**Vulnerable**ó Vulnerable either because rare and uncommon, or found only in a restricted range (even if abundant at some locations), or because of other factors making it vulnerabl to extirpation. Typically 21 to 100 occurrences or between 3,000 and 10,000 individuals.
4	**Apparently Secure**ó Uncommon but not rare, and usually widespread. Possible cause of long-term concern. Usually more than 100 occurrences and more than 10,000 individuals.
5	**Secure**ó Common, widespread, and abundant. Essentially ineradicable under present conditions. Typically with considerably more than 100 occurrences and more than 10,000 individuals.

Qualifiers and Rank Ranges

Qualifier	Definition
# #	**Range Rank**ó A numeric range rank (e.g., S2S3) is used to indicate the range of uncertainty about the exact status of the element. Ranges cannot skip more than one rank (e.g., SU is used rather than S1S4).
?	**Unranked**ó rank not yet assessed.
#	A modifier to X or H; the species has been reintroduced but the population is not yet established.
*	G or S rank has been assigned and is under review. Contact the individual state Natural Heritage program for assigned rank.
HYB	**Hybrid**ó Element not ranked because it represents an interspecific hybrid, not a species.
U	**Unrankable**ó Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
E	**Exotic**ó An established exotic; may be native in nearby regions (e.g., house finch or catal in eastern U.S.).
E#	**Exotic Numeric**ó An established exotic that has been assigned a numeric rank to indicate its status, as defined for G1 or S1 through G5 or S5.
A	**Accidental**ó Accidental or casual, in other words, infrequent and outside usual range. Includes species (usually birds or butterflies) recorded once or only a few times at a location. A few of these species may have bred on the one or two occasions they were recorded. Examples include European strays or western birds on the East Coast and vice-versa.
B	**Breeding**ó Basic rank refers to the breeding population of the element.
C	**Captive or Cultivated**ó Native element presently extant only in captivity or cultivation.
H	**Possibly Extirpated** (Historical)ó Element occurred historically, and there is some expectation that it may be rediscovered. Its presence may not have been verified in the pas 20 years. An element would become GH or SH without such a 20-year delay if the only known occurrences were destroyed or if it had been extensively and unsuccessfully looke for. Upon verification of an extant occurrence, GH or SH-ranked elements would typicall receive a G1 or S1 rank. The GH or SH rank should be reserved for elements for which some effort has been made to relocate occurrences, rather than simply using this rank for a elements not known from verified extant occurrences.
N	**Nonbreeding**ó Basic rank refers to the non-breeding population of the element.
P	**Potential**ó Potential that element occurs but no extant or historic occurrences are accepte
R	**Reported**ó Element reported but without a basis for either accepting or rejecting the repo or the report not yet reviewed locally. Some of these are very recent discoveries for which the program hasn't yet received first-hand information; others are old, obscure reports.
T	Rank for subspecific taxon (subspecies, variety, or population); appended to the global ran for the full species, e.g. G4T3
X	**Presumed Extirpated**ó Element is believed to be extirpated. Not located despite intensiv searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.

CRITERIA USED FOR RANKING

The criteria for ranking are based on a set of quantitative and qualitative factors. These factors are listed below in order of their general importance:

a. Number of Element Occurrences (EOs):
the estimated number of EOs throughout the Elementís global range;

b. Abundance:
the estimated global abundance of the Element (measured by number of individuals, or area, or stream length covered);

c. Size of Range:
the estimated size of the Elementís global range;

d. Distribution trend:
the trend in the Elementís distribution over its global range;

e. Number of protected EOs:
the estimated number of adequately protected EOs throughout the Elementís global range;

f. Degree of threat:
the degree to which the Element is threatened globally;

g. Fragility:
the fragility or susceptibility of the Element to intrusion;

h. Other global considerations:
for example, the quality or condition of EOs that affect or may affect endangerment status; unexplained population fluctuations; reproductive strategies that are dependent on specific habitat; etc.